

A dramatic painting of early Earth. In the foreground, a rugged, brownish-orange volcanic landscape with jagged peaks and a winding river flows towards a dark blue ocean. A large plume of white smoke or steam rises from a volcano in the middle ground. The sky is filled with dark, swirling clouds in shades of purple, blue, and grey. A bright, hazy sun or moon is visible in the upper left, and a thin crescent moon is in the upper right. The overall atmosphere is one of intense geological and atmospheric activity.

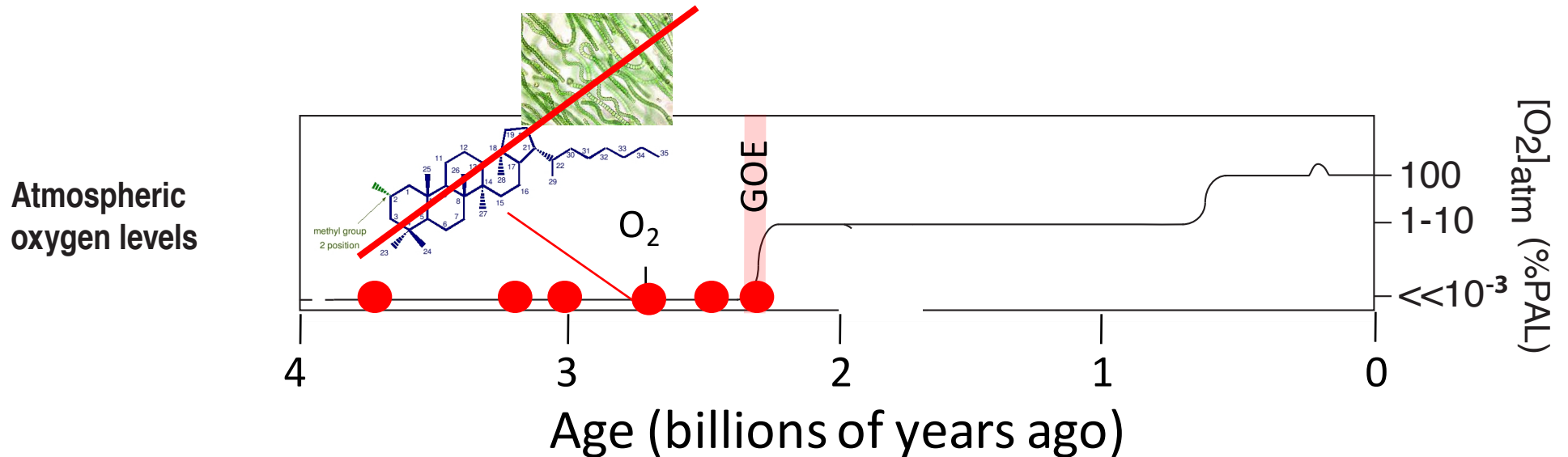
Some Lessons Learned From Early Earth

the importance of the environmental context

Tim Lyons, University of California Riverside

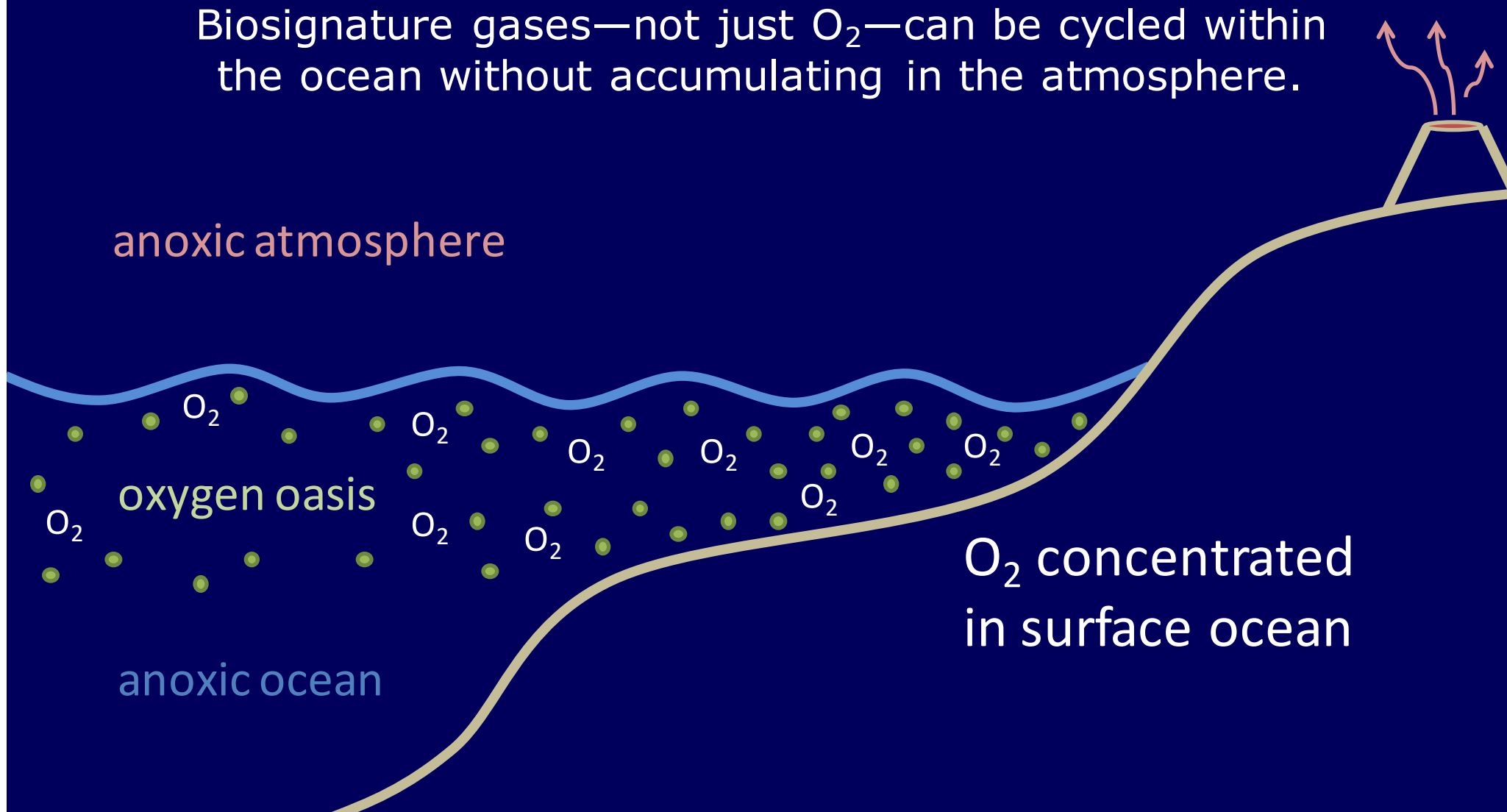
A History of Oxygen in the Atmosphere

The beginnings of oxygenesis and the Great Oxidation Event

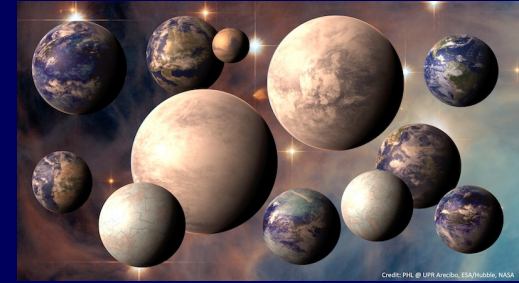


Earth's atmosphere has been an unfaithful reflection of surface chemistry and biology

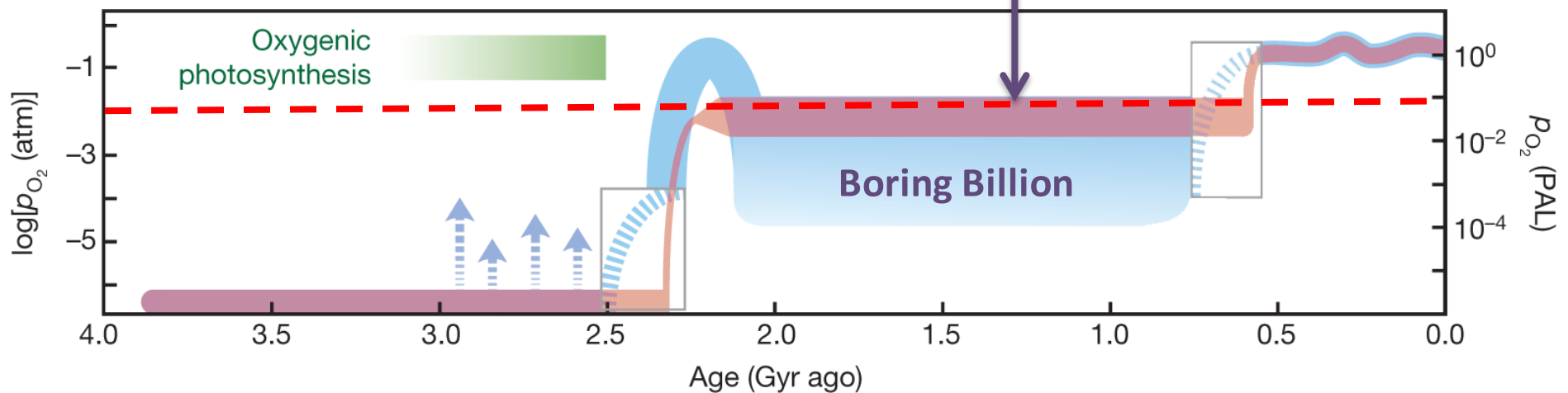
Biosignature gases—not just O_2 —can be cycled within the ocean without accumulating in the atmosphere.



Earth's Oxygenation

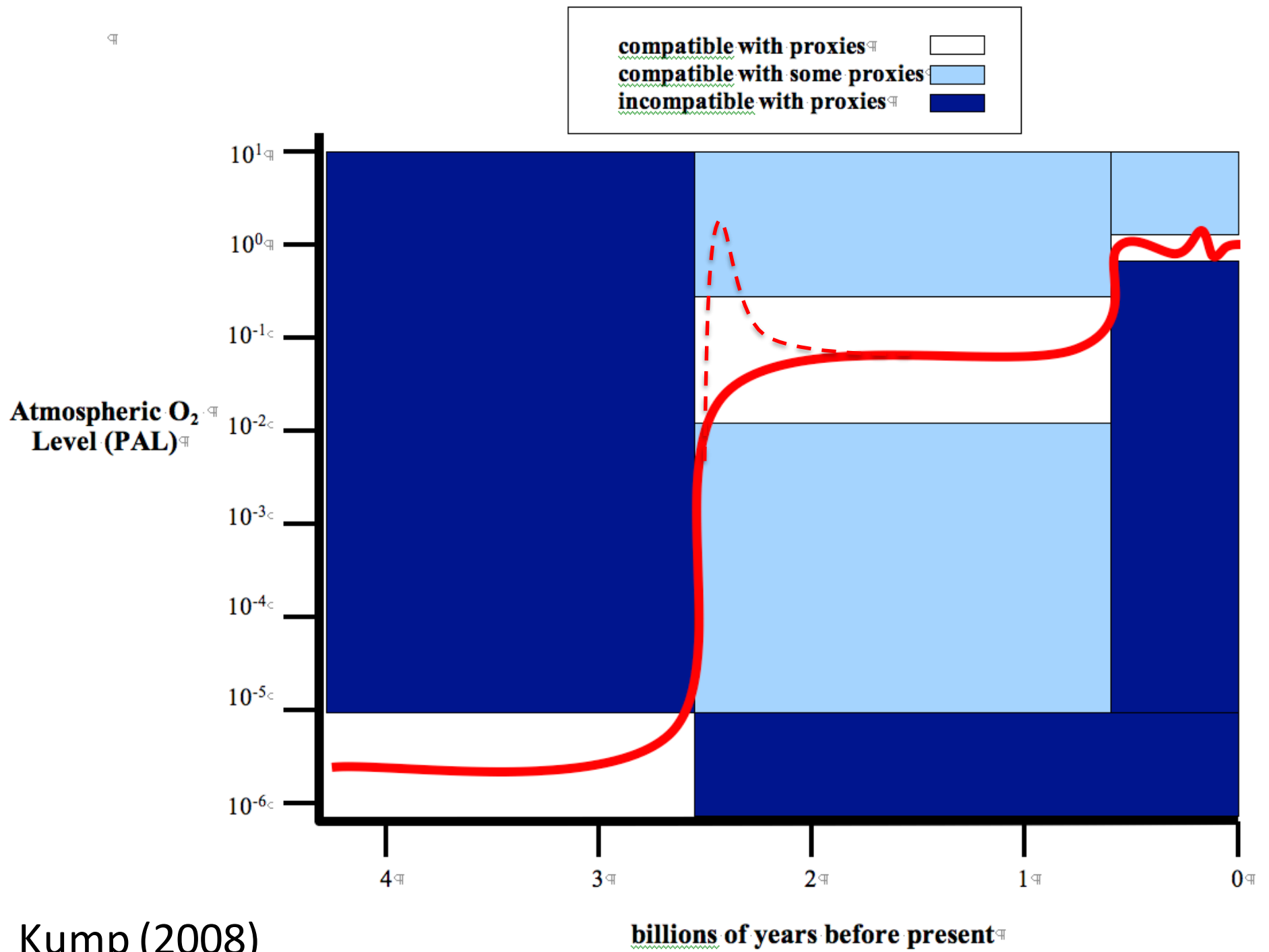


O₂ detection threshold

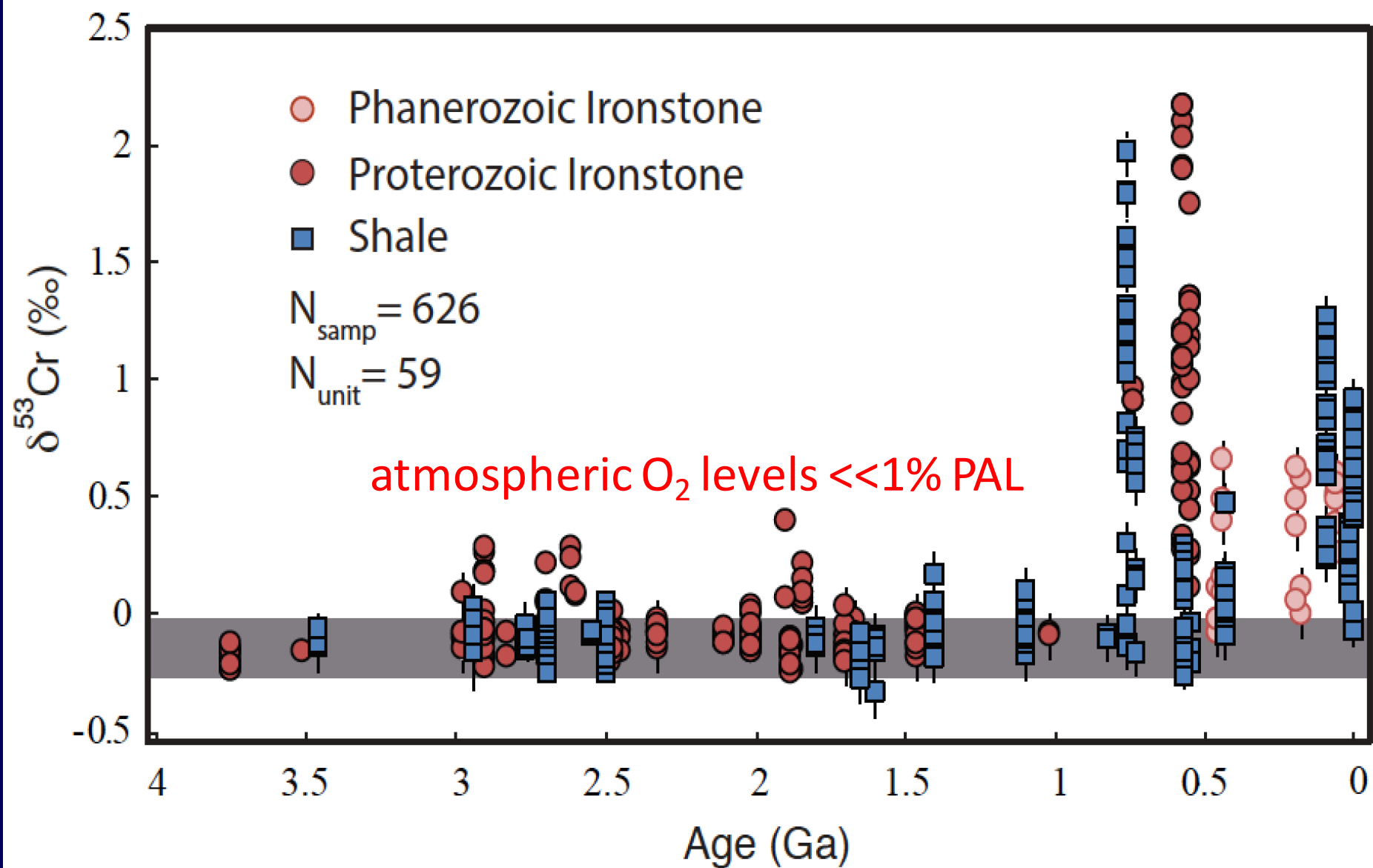


Lyons et al. (2014)

- ✧ Biogenic O₂ may have predated remotely detectable atmospheric O₂ by more than two billion years! **False negatives.**

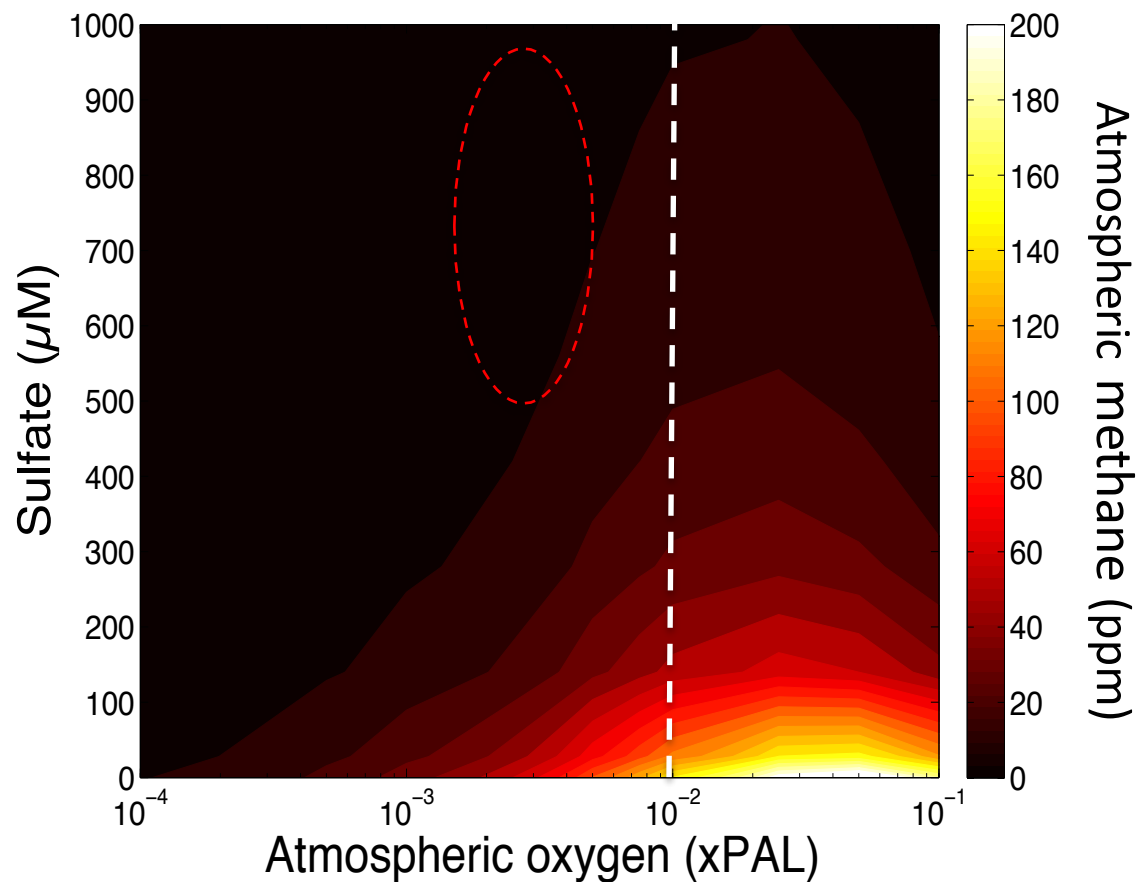


Kump (2008)



Devon Cole et al. (2016)

Mesoproterozoic methane



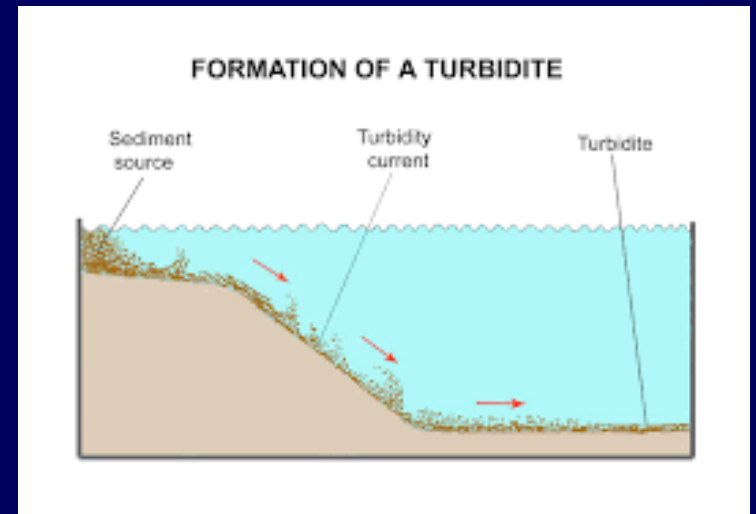
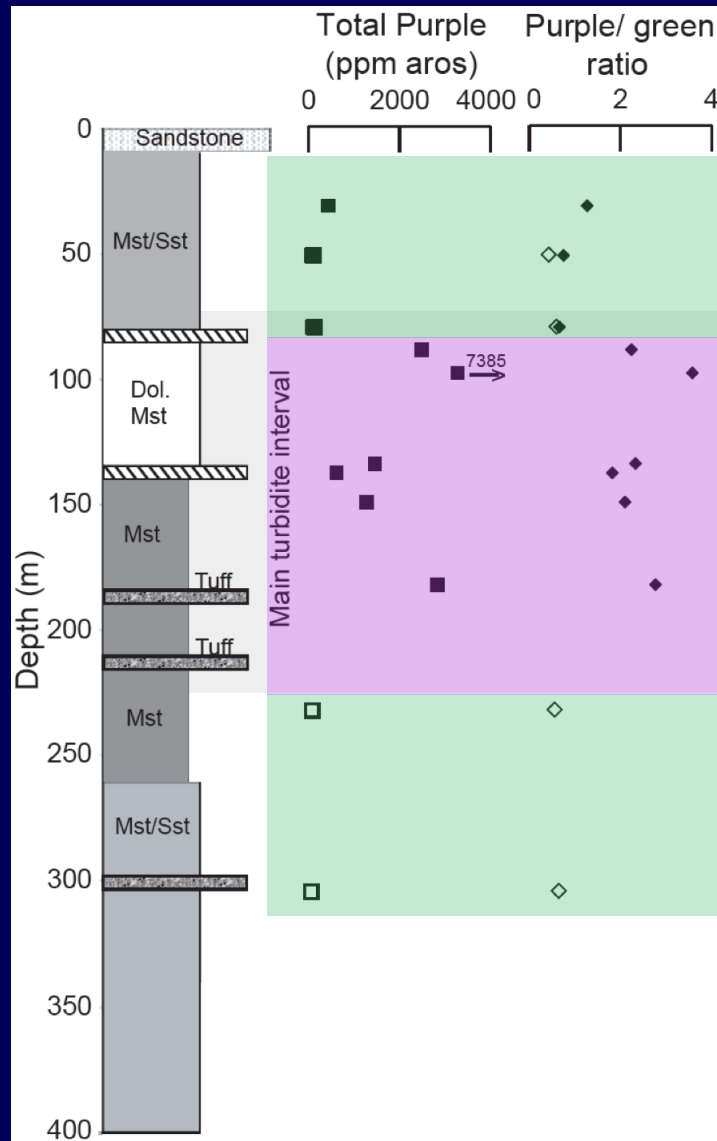
Mesoproterozoic methane may have been ~1-10 ppmv.

Olson *et al.* (in review)

Purple Oceans, Pigments, and the Essential Environmental Context

1.64 Ga
Barney Creek
Fm., Australia

(see Brocks
et al., 2005)



Gordon Love et al.
(in prep.)